What is claimed is:

1. A method of controlling the distribution of electromagnetic fields launched by an excitation coil to excite a plasma in a vacuum plasma processor for processing a workpiece, the coil including plural parallel windings for coupling electromagnetic fields to plasma in the chamber, the method comprising controlling (a) the total amount of power applied to the plural windings so that for different distributions of electromagnetic fields different amounts of total power are applied to the plural windings, and (b) the amount of current applied to individual plural windings so that for different distributions of electromagnetic fields different amounts of current are applied to the individual windings.

2. The method of claim 1 wherein the windings are arranged so (a) one of the windings is an exterior winding located so electromagnetic fields generated by it are in proximity to a peripheral wall of the chamber, and (b) electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, and controlling the current applied to the exterior winding so the electromagnetic fields generated by the exterior winding exceeds the electromagnetic fields generated by the remainder of the coil.

3. The method of claim 1 wherein the windings are arranged so (a) one of the windings is an exterior winding located so electromagnetic fields generated by it are in proximity to a peripheral wall of the chamber, and (b) electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, and controlling the current applied to the exterior winding so the electromagnetic field generated by the exterior winding is less than

the electromagnetic field generated by the remainder of the coil.

4. The method of claim 1 wherein the windings are arranged so (a) one of the windings is an exterior winding located so electromagnetic fields generated by it are in proximity to a peripheral wall of the chamber, and (b) electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, and controlling the current applied to the exterior winding so the electromagnetic field generated by the exterior winding is about the same as the electromagnetic field generated by the remainder of the coil.

5. The method of claim 1 wherein each winding includes first and second terminals, the first terminal being connected via a first series capacitor to an output terminal of a matching network driven by a source of the power, the second terminal being connected via a second series capacitor to a ground terminal, the Sub B2 controlling steps for the current in the individual windings being performed by controlling the value of at least one capacitor associated with each individual winding and the total power in the windings.

6. The method of claim 1 further including maintaining the power coupled to one of the windings substantially constant for different distributions and changing the power coupled to another of the windings for the different distributions.

7. The method of claim 6 wherein the maintaining and changing steps are performed by controlling the values of impedances associated with the Sub B3 individual windings and the total power applied to the coil.

8. The method of claim 7 wherein each winding includes first and second terminals, the first terminal being connected via a first series capacitor to an output terminal of a matching network driven by a source of the power, the second terminal being connected via a second series capacitor to a ground terminal, and controlling the values of the impedances by controlling the values of at least one capacitor associated with each individual winding.

9. The method of claim 8 wherein the effects due to substantial standing wave current variations at a relatively high RF frequency along the lengths of the individual windings are minimized by adjusting the value of at least one capacitor associated with each winding so that adjacent windings have standing wave RF current maxima that are radially opposite to each other.

10. The method of claim 1 wherein the power is RF having a frequency and the windings have lengths such that there are no substantial standing wave current variations along the lengths of the individual windings, and adjusting the value of an impedance coupled with each winding so that there is substantially uniform plasma density distribution on the workpiece.

11. An inductive plasma processor for processing a workpiece, comprising a plasma excitation coil, the coil including plural parallel windings, a source for supplying power to the plural parallel windings, variable impedance arrangements respectively coupled with the parallel windings for controlling the currents flowing from the source to each of the windings, and a controller for controlling the total power the source supplies to the parallel windings and

components of the variable impedance arrangements.

Sub B4

12. The processor of claim 11 wherein the controller is arranged for controlling the total power and the variable impedance arrangements so that for different distributions of electromagnetic fields generated by and supplied by the different windings to the plasma the current flowing in one of the windings remains substantially constant and the current in the remainder of the coil changes.

13. The processor of claim 12 wherein each of the impedance arrangements includes a variable reactance coupled to its respective winding, the variable reactance of each impedance arrangement being arranged for controlling the location of the maximum amplitude of a standing wave current in its respective winding, the controller being arranged for controlling the values of the variable reactance of each impedance arrangement.

14. The processor of claim 13 wherein the source is an RF source, the frequency of the RF source and the length of the windings are such that there are substantial standing wave current variations along the length of each winding.

Sub B5

15. The processor of claim 12 wherein each of the impedance arrangements includes a variable reactance coupled to its respective winding, the variable reactance of each impedance arrangement being arranged for controlling the value of the maximum amplitude of a standing wave RF current in its respective winding, the controller being arranged for controlling the value of the variable reactance of each impedance arrangement.

16. The processor of claim 15 wherein the source is an RF source, the frequency of the RF source and the length of the windings being such that there are

no substantial standing wave current variations along the length of each winding.

17. The processor of claim 12 wherein the source is an RF source, each of the windings including first and second end terminals and each of the impedance arrangements includes first and second variable capacitors, each of the first capacitors being connected in series with its respective first terminal for supplying RF energy from the RF source to the respective winding, each of the second capacitors being connected in series between its respective second terminal and ground, the controller being arranged for controlling the values of the first and second variable capacitors.

Sub B6

18. The processor of claim 17 wherein the first and second capacitors are arranged so their values control the magnitude and location of the maximum amplitude of a standing wave RF current in their respective winding.

19. The processor of claim 12 wherein the source is an RF source, the frequency of the RF source and the length of the windings being such that there are no substantial standing wave current variations along the length of each winding, and each variable impedance arrangement includes a single variable reactance coupled with each winding, the controller being arranged for controlling the value of the variable reactance to control the maximum amplitude of the standing wave current in each winding.

Sub B7

20. An inductive plasma processor for processing a workpiece, comprising a plasma excitation coil, the coil including plural parallel windings, a source for supplying power to the plural parallel windings, impedance arrangements respectively coupled with the parallel windings, the power of the source and the

values of reactances of the impedance arrangements being such that (a) the maximum amplitude of a standing wave current in one of the windings differs from the maximum amplitude of a standing wave current in the remainder of the coil and (b) adjacent windings have standing wave current maxima that are radially opposite to each other.

21. The processor of claim 20 wherein each of the windings is arranged for coupling an electromagnetic field to plasma in the chamber, one of the windings being an exterior winding located so electromagnetic fields generated by it is in proximity to a peripheral wall of the chamber, the remainder of the coil being arranged so electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, the values of the total power the source supplies to the coil and of the reactances being such that the electromagnetic field generated by the exterior winding exceeds the electromagnetic field generated by the remainder of the coil.

22. The processor of claim 20 wherein each of the windings is arranged for coupling an electromagnetic field to plasma in the chamber, one of the windings being an exterior windings located so an electromagnetic field generated by it is in proximity to a peripheral wall of the chamber, the remainder of the coil being arranged so electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, the values of the total power the source supplies to the coil and the reactances being such that the electromagnetic field generated by the exterior winding is less than the electromagnetic field generated by the remainder of the coil.

23. The processor of claim 20 wherein each of the windings is arranged for coupling an electromagnetic field to plasma in the chamber, one of the windings being an exterior winding located so an electromagnetic field generated by it is in proximity to a peripheral wall of the chamber, the remainder of the coil being arranged so electromagnetic fields generated by the remainder of the coil are remote from the chamber peripheral wall, the values of the total power the source supplies to the coil and of the reactances being such that the electromagnetic field generated by the exterior winding is about the same as the electromagnetic field generated by the remainder of the coil.

Sub B1

24. The processor of claim 19 wherein the source is an RF source, the RF source frequency and the lengths of the windings are such that there are no substantial standing wave current variations along the length of each winding, the reactance coupled with each winding being arranged for controlling the value of the standing wave current in the respective winding.

25. An inductive plasma processor for processing a workpiece, comprising a plasma excitation coil, the coil including plural parallel windings, a source for supplying power to the plural parallel windings, impedance arrangements respectively coupled with the parallel windings, the source frequency and the lengths of the windings being such that there are no substantial standing wave current variations along the length of each winding, the impedance arrangement coupled with each winding being arranged for controlling the value of the standing wave current in the respective winding.

Sub B3

Sub B8

26. A method of controlling the plasma flux distribution on a workpiece of an inductive plasma processor including a plasma excitation coil having a center axis and plural parallel windings adapted to be driven by an excitation source, the plural windings being concentric with the axis so an exterior winding of the coil surrounds the remainder of the coil, the method comprising positioning the exterior winding relative to the remainder of the coil so the plasma density incident on the workpiece has a predetermined desired relationship.

27. The method of claim 26 wherein the positioning step includes turning the exterior winding and another winding of the coil relative to each other about the axis.

Add B10